I. A NEW MASS SPECTROMETER

II. THE ISOTOPIC CONSTITUTION OF NEON, ARGON, AND NITROGEN

BY

NORMAN DAVID COGGESHALL

A.B., University of Illinois, 1937

M.S., University of Illinois, 1939

AN ABSTRACT OF A THESIS

SUBMITTED IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY IN PHYSICS IN THE GRADUATE SCHOOL OF THE UNIVERSITY OF ILLINOIS, 1942

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I. A MASS SPECTROMETER OF WIDE ADAPTABILITY

The simultaneous fulfillment of the conditions for: high sensitivity; high dispersion; comparative freedom from space charge effects; simplicity of operation; and inexpensive construction have been obtained in an instrument for the measurement of relative abundances. The ions are created in a magnetic field free region in which the electron beam moves perpendicular rather than parallel to the first positive ion slit. They are then accelerated towards this slit by an electric field which remains fixed throughout an analysis. The ion source in constructed as a removable unit in such a way that an accurate alignment of the slits is accomplished readily and different source arrangements may be used. After leaving the source, the ions are deflected through a mean angle of $\pi/3$ radians by a uniform, sector shaped magnetic field into a Faraday cup.

II. THE ISOTOPIC CONSTITUTION OF NEON, ARGON, AND NITROGEN

Using the mass spectrometer, the isotopic abundance ratios have been established for Neon, Argon, and Nitrogen. The following values were established:

Neon

$$\frac{Ne^{20}}{Ne^{22}} = 9.81 \pm .08 \qquad \frac{Ne^{22}}{Ne^{21}} = 29.4 \pm 1.9$$

Argon

$$\frac{A^{40}}{A^{36}} = 273 \pm 8 \qquad \frac{A^{36}}{A^{38}} = 3.82 \pm .22$$

Nitrogen

$$\frac{N^{14}}{N^{15}} = 261 \pm 4$$

VITA

Norman David Coggeshall was born in Ridgefarm, Illinois, May 15, 1916. He received his elementary and secondary education in the public schools of Indianola, Illinois, and was graduated from high school there in June, 1934. He received the B.A. degree from the University of Illinois in 1937 and the M.S. degree from the same school in 1939. Since 1937, he has carried on graduate work in the Physics Department at the University of Illinois.

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